

WHAT IS CLAIMED IS:

1. A diagnostic apparatus for a fuel cell, which diagnoses a state of the fuel cell, comprising:

an operation device which is used for operating the fuel cell;

an operational state detecting portion which detects a change in an operational state of the fuel cell;

a device control portion which controls the operation device such that the fuel cell is operated according to at least one predetermined operation pattern; and

a diagnostic portion which diagnoses the state of the fuel cell based on the change in the operational state of the fuel cell that is detected by the operational state detecting portion when the fuel cell is operated by the device control portion according to the at least one predetermined operation pattern, and the at least one predetermined operation pattern.

2. The diagnostic apparatus for a fuel cell according to claim 1, wherein the diagnostic portion diagnoses the state of the fuel cell by comparing the change in the operational state of the fuel cell corresponding to each of the operation patterns, which is detected by the operational state detecting portion when the fuel cell is operated by the device control portion according to the at least one predetermined operation pattern, with a change in a change in a normal operational state of the fuel cell corresponding to each of the operation patterns, which is detected by the operational state detecting portion when the fuel cell that normally functions is operated by the device control portion according to the at least one predetermined operation pattern.

3. The diagnostic apparatus for a fuel cell according to claim 2, wherein a relationship between the state of the fuel cell, and presence or absence of an abnormality in the change in the operational state of the fuel cell corresponding to each of the operation patterns is set in the diagnostic portion in advance.

4. The diagnostic apparatus for a fuel cell according to claim 1, wherein the operational state detecting portion detects, as the operational state of the fuel cell, an output current and an output voltage of the fuel cell, and the diagnostic portion diagnoses the state of the fuel cell based on the detected output current and the detected output voltage.

5. The diagnostic apparatus for a fuel cell according to claim 1, wherein the operational state detecting portion detects, as the operational state of the fuel cell, an interterminal voltage and/or a cell voltage when the fuel cell is in an open state, and the diagnostic portion diagnoses the state of the fuel cell based on the detected interterminal voltage and/or the detected cell voltage.
6. The diagnostic apparatus for a fuel cell according to claim 1, wherein the operation device is a gas supply device which is used for supplying a fuel gas and/or an oxidative gas to the fuel cell, and the device control portion controls, according to one of the at least one predetermined operation pattern, the gas supply device such that the fuel gas and/or the oxidative gas is supplied to the fuel cell according to a predetermined supply pattern.
7. The diagnostic apparatus for a fuel cell according to claim 6, wherein the predetermined supply pattern includes one of a predetermined pattern of increasing/decreasing a flow amount of the fuel gas and/or the oxidative gas, a predetermined pattern of increasing/decreasing a supply pressure, and a predetermined pattern of increasing/decreasing a degree of humidification.
8. The diagnostic apparatus for a fuel cell according to claim 1, wherein the operational state detecting portion detects, as the operational state of the fuel cell, an internal resistance of the fuel cell, and the diagnostic portion diagnoses the state of the fuel cell based on the detected internal resistance.
9. The diagnostic apparatus for a fuel cell according to claim 1, wherein the operation device is a temperature adjusting device which is used for adjusting an operation temperature of the fuel cell, and the device control portion controls, according to one of the at least one predetermined operation pattern, the temperature adjusting device such that the fuel cell is operated according to a predetermined temperature pattern.
10. The diagnostic apparatus for a fuel cell according to claim 1, wherein the operational state detecting portion detects, as the operational state of the fuel cell, one of a temperature of the fuel cell, an exhaust gas temperature in a fuel gas system, and an exhaust gas temperature in an oxidative gas system, and the diagnostic portion diagnoses the state of the fuel cell based on one of the temperature of the fuel cell, the exhaust gas temperature in

the fuel gas system, and the exhaust gas temperature in the oxidative gas system, which is detected.

11. The diagnostic apparatus for a fuel cell according to claim 1, wherein the diagnostic portion determines that there is a mechanical failure or deterioration due to a secular change when an output voltage of the fuel cell is less than a predetermined value in a case where the fuel cell is operated according to the at least one predetermined operation pattern.

12. The diagnostic apparatus for a fuel cell according to claim 1, which diagnoses a state of a fuel cell installed in a moving object as a power source, wherein the operation device includes a device installed in the moving object, the operational state detecting portion includes a moving object detecting portion which is installed in the moving object, and which detects a state as the operational state of the fuel cell, the device control portion can be connected to a control system which is installed in the moving object for controlling an operation of the fuel cell, and controls the operation device by giving an instruction to the control system, and the operation device includes a power adjusting portion which adjusts power generated by the fuel cell.

13. The diagnostic apparatus for a fuel cell according to claim 12, wherein the power adjusting portion is connected to an output terminal of the fuel cell, and adjusts the power generated by the fuel cell by absorbing or consuming the power.

14. The diagnostic apparatus for a fuel cell according to claim 12, further comprising:
a fuel gas supply portion which supplies the fuel cell with a fuel gas that is used for power generation of the fuel cell, instead of a fuel gas supply system which is installed in the moving object for supplying the fuel cell with the fuel gas.

15. The diagnostic apparatus for a fuel cell according to claim 12, further comprising:
a cooling portion which cools the fuel cell, instead of a cooling system which is installed in the moving object for cooling the fuel cell.

16. A diagnostic method for a fuel cell, which is a method for diagnosing a state of the fuel cell, includes the steps of:

- (a) operating the fuel cell according to at least one predetermined operation pattern;
- (b) detecting a change in an operational state of the fuel cell corresponding to each of the operation patterns when the fuel cell is operated according to the at least one predetermined operation pattern; and
- (c) diagnosing the state of the fuel cell based on the detected change in the operational state and the at least one predetermined operation pattern.

17. The diagnostic method for a fuel cell according to claim 16, wherein in the step (c), the state of the fuel cell is diagnosed by comparing the change in the operational state of the fuel cell corresponding to each of the operation patterns, which is detected when the fuel cell is operated according to the at least one predetermined operation pattern, with a change in a normal operational state of the fuel cell corresponding to each of the operation patterns, which is detected when the fuel cell that normally functions is operated according to the at least one predetermined operation pattern.

18. The diagnostic method for a fuel cell according to claim 16, wherein in the step (a), the fuel cell is operated according to one of a predetermined pattern of increasing/decreasing a flow amount of a fuel gas and/or an oxidative gas that is supplied to the fuel cell, a predetermined pattern of increasing/decreasing a supply pressure, and a predetermined pattern of increasing/decreasing a degree of humidification, as one of the operation patterns.

19. The diagnostic method for a fuel cell according to claim 16, wherein in the step (b), one of i) an output current and an output voltage of the fuel cell, ii) an interterminal voltage or a cell voltage when the fuel cell is in an open state, iii) an internal resistance of the fuel cell; iv) a temperature of the fuel cell, v) an exhaust gas temperature in a fuel gas system of the fuel cell, vi) and an exhaust gas temperature in an oxidative gas system of the fuel cell is detected as the operational state.